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ORIGINAL ARTICLE

Eczema Prevalence in the United States: Data from the 2003 National Survey of Children's Health

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Using the 2003 National Survey of Children's Health sponsored by the federal Maternal and Child Health Bureau, we calculated prevalence estimates of eczema nationally and for each state among a nationally representative sample of 102,353 children 17 years of age and under. Our objective was to determine the national prevalence of eczema/atopic dermatitis in the US pediatric population and to further examine geographic and demographic associations previously reported in other countries. Overall, 10.7% of children were reported to have a diagnosis of eczema in the past 12 months. Prevalence ranged from 8.7 to 18.1% between states and districts, with the highest prevalence reported in many of the East Coast states, as well as in Nevada, Utah, and Idaho. After adjusting for confounders, metropolitan living was found to be a significant factor in predicting a higher disease prevalence with an odds ratio of 1.67 (95% confidence interval of 1.19–2.35, $P=0.008$). Black race (odds ratio 1.70, $P=0.005$) and education level in the household greater than high school (odds ratio 1.61, $P=0.004$) were also significantly associated with a higher prevalence of eczema. The wide range of prevalence suggests that social or environmental factors may influence disease expression.

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INTRODUCTION

Atopic dermatitis (AD) is a global public health concern considering its increasing prevalence and mounting financial costs to health systems (Lapidus *et al.*, 1993; Ellis *et al.*, 2002; Carroll *et al.*, 2005). The ISAAC (International Study of Asthma and Allergies in Childhood) revealed that AD affects children across the globe, although the disease prevalence varies substantially between countries (Asher *et al.*, 2006). The prevalence of AD is also increasing, especially in developing countries (Asher *et al.*, 2006). The factors that underlie disease prevalence, geographic variability, and secular trends are unknown (Burney *et al.*, 1990; Williams *et al.*, 1995), although industrialization and urban living are correlated with elevated rates of atopic disease (Keeley *et al.*, 1991; Addo Yobo *et al.*, 1997; Yemaneberhan *et al.*, 1997; Mercer *et al.*, 2004).

Most data regarding AD prevalence in industrialized countries are derived from the study of European populations. Only three previous studies of AD prevalence have reported data from a US population (Laughter *et al.*, 2000; Asher *et al.*, 2006; Hanifin *et al.*, 2007), with the scope of two of these limited to one state. The third and most recent study did not examine geographical trends (Hanifin *et al.*, 2007). Further data regarding disease prevalence, geographic variation, and risk factors are required from the United States.

The primary objective of this study was to determine the prevalence of AD in the United States using data obtained from the National Survey of Children's Health (NSCH), a large population-based survey of >100,000 families representing all 50 states. We examined the geographical distribution of the disease and explored whether certain risk factors and associations previously reported in Europe and Asia were also present in the US population.

RESULTS

Univariate analyses

Overall, a total of 9,752 children had a diagnosis of eczema, which translated to a 10.7% national prevalence of eczema in children under 18 years of age. The disease prevalence ranged from 8.7 to 18.1% between states and districts. Figure 1 and Table 1 present state prevalence estimates for US children (0–17 years of age), who were reported to have a diagnosis of eczema in the past 12 months. The highest state prevalence values were reported in many East Coast states, as well as in Utah, Idaho, and Nevada. The lowest state prevalence values were in the middle and southwestern parts of the country (Table 1).

Of those children with eczema, 30.7% reported concurrent hay fever and 22.8% reported concurrent asthma consistent with similar AD populations in Europe (Asher *et al.*, 2006; Van der Hulst *et al.*, 2007). As expected, age of the child was a significant determinant of eczema prevalence, given the natural course of the disease (Table 2).

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Abbreviations: AD, atopic dermatitis; ISAAC, International Study of Asthma and Allergies in Childhood; NSCH, National Survey of Children's Health; RUCA, Rural-Urban Commuting Area; SLAITS program, State and Local Area Integrated Telephone Survey

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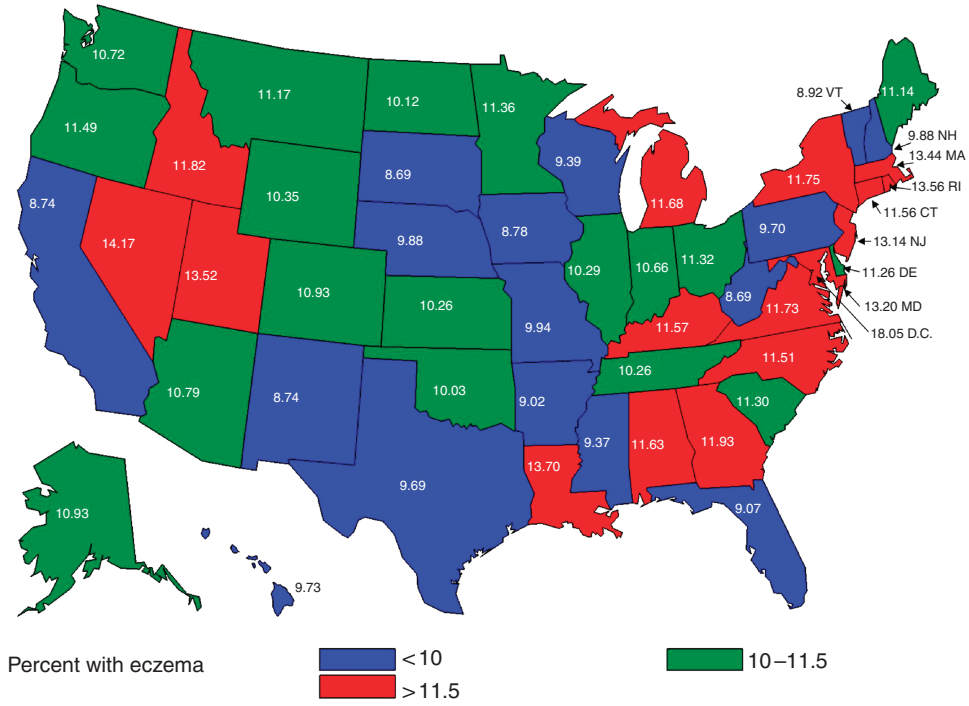

Figure 1. Eczema prevalence in the United States shows a trend toward higher disease prevalence in the East Coast states.

There was a significant effect of the highest reported education level in the household on eczema prevalence, with those households reporting education levels greater than high school having the greatest prevalence of eczema (Table 2). Other significant demographic variables showing positive associations with disease prevalence included living in a metropolitan area (defined using RUCA (Rural-Urban Commuting Area) codes), speaking English as the primary language, and being of Black or multiple race (Table 2).

The birthplace of parents or child was associated with disease prevalence. Children or parents born outside the United States reported a lower prevalence of eczema (Table 3). A significant association was also found with health insurance status. Children with health insurance had greater eczema prevalence than did those without (10.9 versus 8.2%, $P=0.0004$), possibly reflecting health-care access disparities.

Eczema prevalence showed an association with family structure, with single mothers reporting the highest prevalence (Table 4). Single child homes had a higher prevalence than did families with more than one child, but birth order did not seem to influence disease prevalence. Children reported to regularly receive child care had a significantly higher prevalence of eczema than did those who did not (Table 5), with the highest prevalence being seen in those who attended child care outside home. Smoking in the home showed no association with eczema prevalence.

Multivariate analysis

We developed a logistic regression model to better explain the relationship between area of residency (metropolitan area versus rural area) and eczema prevalence. After adjusting for potential confounders, including race and age of child, parental education level, household income, and health insurance coverage status, metropolitan living continued to be a significant factor in predicting a higher disease prevalence with an odds ratio of 1.67 (95% confidence interval of 1.19–2.35, $P=0.008$) compared with rural living. Black race (odds ratio 1.70, $P=0.005$) and education level in the household greater than high school (odds ratio 1.61, $P=0.004$) were also significantly associated with a higher prevalence of eczema compared with White race and education level less than high school, respectively (Table 6).

In addition to adjusting for the main effects of potential confounders, interactive effects of insurance coverage, race, and metropolitan residency were included in the final model to better adjust for possible inequities in health-care access. Statistically significant interaction terms included insurance status by metropolitan residency ($P=0.047$), and the three-way interaction between insurance, race, and residency ($P=0.04$), suggesting that uninsured and insured, as well as the different racial subgroups, may have experienced differences in health-care access depending on their residency status.

DISCUSSION

Our large population-based study found the prevalence of AD in the United States to be ~10.7% with a significant variation between states and districts. Urban living and being of Black race were significantly associated with a higher prevalence of eczema after controlling for possible confounders. A general geographic trend toward higher disease prevalence in the East Coast states was also found. We confirmed known demographic AD associations previously observed only in European populations, including the

Table 1. Eczema prevalence by state

State/district	Frequency[1]	Percentage[2]	95% Confidence interval
West Virginia	159	8.69	(7.21, 10.18)
South Dakota	136	8.69	(6.93, 10.46)
California	180	8.74	(7.26, 10.22)
New Mexico	142	8.74	(7.08, 10.39)
Iowa	159	8.78	(7.27, 10.30)
Vermont	154	8.92	(7.30, 10.54)
Arkansas	139	9.02	(7.31, 10.73)
Florida	159	9.07	(7.34, 10.80)
Mississippi	147	9.37	(7.56, 11.19)
Wisconsin	162	9.39	(7.78, 11.00)
Texas	174	9.69	(8.08, 11.30)
Pennsylvania	200	9.70	(8.18, 11.23)
Hawaii	173	9.73	(8.04, 11.43)
Nebraska	147	9.88	(8.09, 11.66)
New Hampshire	179	9.88	(8.35, 11.41)
Missouri	189	9.94	(8.36, 11.52)
Oklahoma	165	10.03	(8.36, 11.71)
North Dakota	154	10.12	(8.31, 11.93)
Tennessee	176	10.26	(8.49, 12.03)
Kansas	156	10.26	(8.40, 12.11)
Illinois	203	10.29	(8.61, 11.98)
Wyoming	168	10.35	(8.67, 12.02)
Indiana	164	10.66	(8.84, 12.48)
Washington	190	10.72	(9.07, 12.37)
Arizona	152	10.79	(8.86, 12.71)
Alaska	165	10.93	(9.08, 12.78)
Colorado	194	10.93	(9.21, 12.65)
Maine	187	11.14	(9.36, 12.92)
Montana	185	11.17	(9.38, 12.96)
Delaware	228	11.26	(9.67, 12.86)
South Carolina	208	11.30	(9.60, 13.00)
Ohio	220	11.32	(9.66, 12.97)
Minnesota	168	11.36	(9.39, 13.32)
Oregon	188	11.49	(9.69, 13.29)
North Carolina	204	11.51	(9.75, 13.27)
Connecticut	241	11.56	(9.93, 13.20)
Kentucky	204	11.57	(9.80, 13.33)
Alabama	216	11.63	(9.84, 13.41)
Michigan	222	11.68	(9.98, 13.39)
Virginia	220	11.73	(9.97, 13.49)
New York	222	11.75	(10.01, 13.49)
Idaho	169	11.82	(9.93, 13.71)
Georgia	192	11.93	(10.00, 13.86)
New Jersey	270	13.14	(11.36, 14.91)
Maryland	261	13.20	(11.37, 15.03)
Massachusetts	265	13.44	(11.65, 15.23)
Utah	169	13.52	(11.39, 15.65)
Rhode Island	258	13.56	(11.68, 15.45)
Louisiana	250	13.70	(11.74, 15.66)
Nevada	226	14.17	(12.17, 16.18)
District of Columbia	293	18.05	(15.64, 20.45)

[1]Raw frequency of surveyed subjects with eczema.
[2]Weighted percentage of state pediatric population with eczema.

association of AD with higher education levels, higher household incomes, and smaller family sizes. Notable associations not observed in our study included a lack of association with smoking in the household, breast feeding, birth order, gender, or body mass index. The lack of a correlation between body mass index and eczema is supportive of current studies that show no relationship between body mass index and eczema (Leung *et al.*, 2009; Van Gysel *et al.*, 2009).

Our findings of an AD prevalence of 10.7% in US children 0–17 years of age agree with reported estimates from the three previous US-based studies of AD prevalence. A study by Hanifin reporting the results of a 1998 survey found that 17.1% of the study population had at least one of four eczematous symptoms, whereas 10.7% of respondents reported empirically defined eczema (Hanifin *et al.*, 2007). The study by Laughter *et al.* (2000) reported that of 1,465 Oregon schoolchildren, 5–9 years of age, a prevalence of 11.8% was found based on the question, ''Has a doctor ever said that your child has eczema?'' Using the self-administered Schultz Larsen questionnaire, a 17.2% lifetime prevalence was found in that study. The global ISAAC study, in which the United States was represented by a sample of 2,422 children from 1 medical center in Seattle, found the prevalence of eczema symptoms to be 8.3% (Lapidus *et al.*, 1993). Our study estimate was slightly higher, with a prevalence estimate of 10.7% in the state of Washington.

Similar to the ISAAC study, which revealed striking worldwide geographic variability in AD prevalence, our data revealed significant geographic variability in disease prevalence within the United States with a higher prevalence in the East Coast states. The reason for this variability is not known and is likely multifactorial. One explanation may be the presence of a higher number of metropolitan centers in the Eastern versus Western United States. Our data revealed a higher eczema prevalence rate in metropolitan areas even when controlling for confounders. Several previous studies of atopic disease have reported a similar increase in disease prevalence in metropolitan/urban areas compared with rural areas (Keeley *et al.*, 1991; Addo Yobo *et al.*, 1997; Yemaneberhan *et al.*, 1997; Laughter *et al.*, 2000; Mercer

Table 2. Eczema prevalence stratified by primary demographic variables

Variable	Subgroup	Frequency[1]	Percentage[2]	95% Confidence interval	*P*-value[3]
Age	<4 years	2,977	13.92	(13.12, 14.73)	<0.0001
	4–8 years	2,623	10.63	(9.98, 11.27)	
	9–12 years	1,862	9.96	(9.23, 10.68)	
	13–17 years	2,290	8.56	(7.97, 9.16)	
Gender	Male	4,874	10.52	(10.04, 11.01)	0.3507
	Female	4,867	10.85	(10.36, 11.34)	
Highest education level completed by parent	<HS	278	6.95	(5.63, 8.27)	<0.0001
	HS	1,721	9.61	(8.89, 10.33)	
	>HS	7,721	11.47	(11.06, 11.88)	
Residence in metropolitan area	No	1,442	8.53	(7.90, 9.16)	<0.0001
	Yes	5,161	10.99	(10.55, 11.43)	
Primary language spoken at home	English	9,273	11.15	(10.78, 11.51)	<0.0001
	Any other	474	6.91	(5.89, 7.94)	
Race	White only	6,770	9.70	(9.34, 10.05)	<0.0001
	Black only	1,464	15.89	(14.64, 17.14)	
	Multiple race	550	15.03	(12.97, 17.10)	
	Other	470	10.08	(8.36, 11.80)	
Household income	0–99% FPL	1,037	10.38	(9.40, 11.37)	0.0357
	100–199% FPL	1,732	11.09	(10.18, 12.00)	
	200–399% FPL	3,135	10.21	(9.65, 10.77)	
	⩾400% FPL	3,024	11.53	(10.91, 12.15)	

Abbreviations: FPL, federal poverty level; HS, high school.
[1]Raw frequency of surveyed subjects with eczema.
[2]Weighted percentage of subgroup population with eczema.
[3]Rao–Scott χ^2 test for equal proportions.

Table 3. Eczema prevalence stratified by birthplace variables

Variable	Subgroup	Frequency[1]	Percentage[2]	95% Confidence interval	*P*-value[3]
Child's mother born in the United States	No	912	9.08	(8.09, 10.07)	0.0004
	Yes	8,352	11.14	(10.76, 11.52)	
Child's father born in the United States	No	739	9.27	(8.15, 10.39)	0.0297
	Yes	6,508	10.66	(10.24, 11.07)	
Child born in the United States	No	233	6.80	(5.28, 8.32)	<0.0001
	Yes	9,431	10.84	(10.49, 11.19)	

[1]Raw frequency of surveyed subjects with eczema.
[2]Weighted percentage of subgroup population with eczema.
[3]Rao–Scott χ^2 test for equal proportions.

et al., 2004). Potential explanations for this phenomenon include metropolitan-related environmental factors, such as exposure to environmental pollution (Asher *et al.*, 2006). For example, an increased prevalence of allergic disease in Ethiopia was associated with the use of modern fuels, particularly kerosene use in homes (when compared with other biomass fuel) (Venn *et al.*, 2001). Another possibility noted by von Hertzen and Haahtela (2006) was the heavy exposure to microorganisms in soil and vegetation when living in rural farming areas. Cultural and behavioral factors that affect the skin barrier may also have a role. Sherriff *et al.* (2002) found a correlation between an increased hygiene score (that included the frequency of washing/wiping hands and faces and bathing practices of young children) and

Table 4. Eczema prevalence stratified by family structure variables

Variable	Subgroup	Frequency[1]	Percentage[2]	95% Confidence interval	*P*-value[3]
Number of children in household	One child	4,149	11.82	(11.30, 12.35)	0.0039
	Two children	3,700	10.75	(10.25, 11.24)	
	Three children	1,382	10.07	(9.29, 10.86)	
	Four or more children	521	9.78	(8.52, 11.04)	
Birth order in families with two or more children	Oldest child	2,182	9.72	(9.10, 10.33)	0.1098
	Second oldest child	2,590	10.97	(10.34, 11.59)	
	Third oldest child	640	10.07	(8.88, 11.26)	
	Fourth oldest child	191	11.14	(8.75, 13.52)	
Family structure	Two-parent biological/adopted	6,378	10.68	(10.26, 11.10)	0.0013
	Two-parent stepfamily	680	9.97	(8.70, 11.23)	
	Single mother/no father present	2,179	11.42	(10.65, 12.20)	
	Other	296	7.68	(6.14, 9.22)	

[1]Raw frequency of surveyed subjects with eczema.
[2]Weighted percentage of subgroup population with eczema.
[3]Rao–Scott χ^2 test for equal proportions.

Table 5. Eczema prevalence stratified by environmental variables

Variable	Subgroup	Frequency[1]	Percentage[2]	95% Confidence interval	*P*-value[3]
During the past month did child regularly attend a child-care center?	No	2,508	11.60	(10.89, 12.31)	<0.0001
	Yes	1,598	15.41	(14.14, 16.67)	
Does anyone in the household use cigarettes, cigars, or pipe tobacco?	No	5,717	10.40	(9.96, 10.83)	0.8966
	Yes	2,413	10.45	(9.78, 11.12)	

[1]Raw frequency of surveyed subjects with eczema.
[2]Weighted percentage of subgroup population with eczema.
[3]Rao–Scott χ^2 test for equal proportions.

Table 6. Subgroup comparisons of variables included in multivariate model

Variable	Contrast	Odds ratio	SE	95% Confidence interval	*P*-value[1]
Residence in metropolitan area	Metro versus rural	1.67	0.29	(1.19, 2.35)	0.0079
Race	Black versus white	1.70	0.29	(1.22, 2.37)	0.0048
	Multiple race versus white	0.84	0.18	(0.56, 1.27)	0.5033
	Other versus white	0.95	0.22	(0.60, 1.49)	0.8513
Age category	<4 years versus 13–17 years	1.77	0.11	(1.57, 2.00)	<0.0001
	4–8 years versus 13–17 years	1.27	0.08	(1.13, 1.43)	0.0006
	9–12 years versus 13–17 years	1.15	0.08	(1.01, 1.31)	0.0640
Highest education level completed by parent	HS versus <HS	1.34	0.20	(1.00, 1.78)	0.0799
	>HS versus <HS	1.61	0.23	(1.21, 2.13)	0.0038
Income as a percentage of poverty level	100–199% versus 0–99%	1.11	0.09	(0.94, 1.31)	0.2938
	200–399% versus 0–99%	0.99	0.08	(0.84, 1.15)	0.8513
	⩾400% versus 0–99%	1.13	0.09	(0.96, 1.32)	0.2304

[1]Wald χ^2 test adjusted for multiple comparisons by false discovery rate method.

subsequent eczema risk. Whether skin care practices vary between rural and metropolitan inhabitants is not known.

An unexpected association in our study was the greater prevalence of eczema in Black and multirace populations compared with Whites. Hanifin did not find statistically significant differences between various race populations and their prevalence of eczema. A few previous studies have reported racial disparities in eczema prevalence (Davis *et al.*, 1961; Schachner *et al.*, 1983; Williams *et al.*, 1995). In the most recent study, Williams *et al.* (1995) found a higher prevalence of AD in Black Caribbean individuals in London compared with Whites. Using medical care usage as a proxy for disease prevalence, Horii *et al.* (2007) reported an increased use of medical care for AD by Blacks and Asian/Pacific Islanders when compared with Whites. It is not known whether these racial differences derive from environmental or genetic influences. There are no large studies of the prevalence of common filaggrin mutations in an African population. Studies in asthma have also reported similar racial disparities and differences in socioeconomic status and air quality have been proposed as the possible explanations (Gorman, 2009).

A significant limitation of our study was that we could not be certain whether geographic differences in disease prevalence reflected differences in access to medical care or dermatological specialty care. There are fewer dermatologists per capita in rural areas compared with urban areas, although wait time to be seen by a dermatologist was not statistically different between urban and rural areas (Uhlenhake *et al.*, 2009). Our regression model controlled for this issue, but this does not eliminate the potential bias completely. Another limitation of this study was the nature of the self-reported survey data collection. Diagnoses were not confirmed by a chart review or direct examination of the patients. Single questions addressing parent recall of physician-diagnosed eczema that have been validated and used in other prevalence studies reported a high concordance between using a similar single question (''Has a doctor ever said that your child has eczema?'') with direct clinical examination and questionnaire diagnosis of AD (Laughter *et al.*, 2000). Another study from Germany tested the validity of the diagnosis of AD using the question, ''Has a physician ever diagnosed eczema in your child?'' It showed 63% sensitivity and 88% specificity using dermatological exam as the gold standard (Kramer *et al.*, 1998). On the basis of the results of these studies, the wording of the question in this survey has adequate sensitivity and specificity to provide meaningful data on eczema prevalence. Finally, these survey data are now 7 years old.

MATERIALS AND METHODS

Data source

We used data obtained from the 2003 NSCH survey of 102,353 households, which was designed to estimate the prevalence of various child health issues, including physical, emotional, and behavioral factors. The NSCH was sponsored by the Maternal and Child Health Bureau and the US Department of Health and Human Services. The National Center for Health Statistics conducted a total of 102,353 interviews using the SLAITS (State and Local Area Integrated Telephone Survey) program. The telephone numbers were chosen at random, followed by identification of the households with one or more children under the age of 18 years. Subsequently, one child was randomly selected for interview. The survey results were weighted to represent the population of noninstitutionalized children nationally and in each state. Using data obtained from the US Bureau of the Census, weights were adjusted for age, sex, race, ethnicity, household size, and educational attainment of the most educated household member to provide a data set that was more representative of each state's population of noninstitutionalized children <18 years of age. The National Center for Health Statistics of Center for Diseases Control and Prevention oversaw sampling and telephone interviews. More detailed information on the survey has been previously published (Blumberg *et al.*, 2005).

Study variables

We calculated the period prevalence of AD/eczema using the NSCH question, ''During the past 12 months, have you been told by a doctor or other health professional that (child's name) had eczema or any kind of skin allergy?''

To limit the effect health-care access may have on the results, we excluded all subjects who responded ''no'' to the question, ''During the past 12 months, did (child) see a doctor, nurse, or other health care professional for any kind of medical care, including sick-child care, well-child check-ups, physical exams, and hospitalizations?'' We also included health-care insurance status in our final regression model when we examined the role of metropolitan living on AD prevalence.

NSCH data were interpreted to calculate the national prevalence of eczema for the United States and for each state. Further investigation into the influences of race, geography, socioeconomic status, education levels, family size, place of residence, and birth order was performed based on previously described associations in the literature found in European populations (Hanifin, 2009).

Statistical methods

Analyses were performed using SURVEY procedures in SAS version 9.2 (SAS, Cary, NC, USA). Univariate associations were tested by the Rao–Scott χ^2 method. Multivariate results were obtained by logistic regression for domains of weighted survey data. Regression analysis did not include data from many states (including Alaska, Connecticut, Delaware, Hawaii, Idaho, Maine, Maryland, Massachusetts, Montana, Nevada, New Hampshire, North Dakota, Rhode Island, South Dakota, Vermont, and Wyoming) for which metropolitan residency status was unavailable. The regression model used residency status (metropolitan versus rural) to predict diagnosis of pediatric eczema while controlling for potential demographic confounders, including race and age and health insurance coverage status. The number of children living in the home was not significantly associated with eczema diagnosis; therefore, this variable was removed to simplify the model. Interactive effects between race, insurance status, and metropolitan residency were included in an attempt to better control for inequity in health-care access between races and areas of residency. Odds ratios for specific demographic comparisons were determined using the final multivariate model, and their *P*-values were adjusted for multiple comparisons using the false discovery rate method (Table 6).

CONFLICT OF INTEREST

The authors state no conflict of interest.

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REFERENCES

Addo Yobo EO, Custovic A, Taggart SC *et al.* (1997) Exercise induced bronchospasm in Ghana: differences I prevalence between urban and rural schoolchildren. *Thorax* 52:161–5

Asher MI, Montefort S, Bjorksten B *et al.* (2006) Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC phase one and three repeat multicountry cross-sectional surveys. *Lancet* 368:733–43

Blumberg SJ, Olson L, Frankel M *et al.* (2005) Design and operation of the National Survey of Children's Health (NSCH). *Vital Health Stat* 143:1–124. National Survey of Children's Health (NSCH), 2003, www.childhealthdata.org

Burney PG, Chinn S, Rona RJ (1990) Has the prevalence of asthma increased in children? Evidence from the National Study of Health and Growth, 1973–1986. *BMJ* 300:1306–10

Carroll CL, Balkrisyhnan R, Feldman SR *et al.* (2005) The burden of atopic dermatitis: impact on the patient, family and society. *Pediatr Dermatol* 22:192–9

Davis LR, Marten RH, Sarkany I (1961) Atopic eczema in European and Negro West India infants in London. *Br J Dermatol* 73:410–4

Ellis C, Drake L, Prendergast M *et al.* (2002) Cost of atopic dermatitis and eczema in the United States. *J Am Acad Dermatol* 46:361–70

Gorman BK (2009) Racial and ethnic differences in adult asthma prevalence, problems, and medical care. *Ethn Health* 14:527–52

Hanifin JM, Reed ML (2007) A population-based survey of eczema prevalence in the United States. *Dermatitis* 82:82–91

Hanifin JM (2009) Evolving concepts of pathogenesis in atopic dermatitis and other eczemas. *J Invest Dermatol* 129:320–2

Horii KA, Simon SD, Liu DY *et al.* (2007) Atopic dermatitis in children in the United States, 1997–2004: visit trends, patient and provider characteristics, and prescribing patterns. *Pediatrics* 120:e527–34

Keeley DJ, Neill P, Gallivan S (1991) Comparison of the prevalence of reversible airways obstruction in rural and urban Zimbabwean children. *Thorax* 46:549–53

Kramer K, Schäfer T, Behrendt H *et al.* (1998) The influence of cultural and educational factors on the validity of symptom and diagnosis questions for atopic eczema. *Br J Dermatol* 139:1040–6

Lapidus CS, Schwarz DF, Honig PJ (1993) Atopic dermatitis in children: who cares? Who pays? *J Am Acad Dermatol* 28:699–703

Laughter D, Istvan JA, Tofte SJ *et al.* (2000) The prevalence of atopic dermatitis in Oregon schoolchildren. *J Am Acad Dermatol* 43:649–55

Leung TF, Kong AP, Chan IH *et al.* (2009) Association between obesity and atopy in Chinese schoolchildren. *Int Arch Allergy Immunol* 149:133–40

Mercer MJ, Joubert G, Ehrlich RI *et al.* (2004) Socioeconomic status and prevalence of allergic rhinitis and atopic eczema symptoms in young adolescents. *Pediatr Allergy Immunol* 15:234–41

Schachner L, Ling LS, Press S (1983) A statistical analysis of a pediatric dermatology clinic. *Pediatr Dermatol* 1:157–64

Sherriff A, Golding J (2002) Hygiene levels in a contemporary population cohort are associated with wheezing and atopic eczema in preschool infants. *Arch Dis Child* 87:26–9

Van der Hulst A, Klip H, Brand P (2007) Risk of developing asthma in young children with atopic eczema: a systematic review. *J Allergy Clin Immunol* 120:565–9

Van Gysel D, Govaere E, Verhamme K *et al.* (2009) Body mass index in Belgian schoolchildren and its relationship with sensitization and allergic symptoms. *Pediatr Allergy Immunol* 20:246–53

Venn AJ, Yemaneberhan H, Bekele Z *et al.* (2001) Increased risk of allergy associated with the use of kerosene fuel in thehome. *Am J respire Crit Care Med* 164:1660–4

von Hertzen L, Haahtela T (2006) Disconnection of man and the soil: reason for the asthma and atopy epidemic. *J Allergy Clin Immunol* 117:334–44

Uhlenhake E, Brodell R, Mostow E (2009) The dermatology workforce: a focus on urban versus rural wait times. *J Am Acad Dermatol* 61: 17–22

Williams HC, Pembroke AC, Forsdyke H *et al.* (1995) London-born Black Caribbean children are at increased risk of atopic dermatitis. *J Am Acad Dermatol* 32:212–7

Yemaneberhan H, Bekele Z, Venn A *et al.* (1997) Prevalence of wheeze and asthma and relation to atopy in urban and rural Ethiopia. *Lancet* 350:85–90